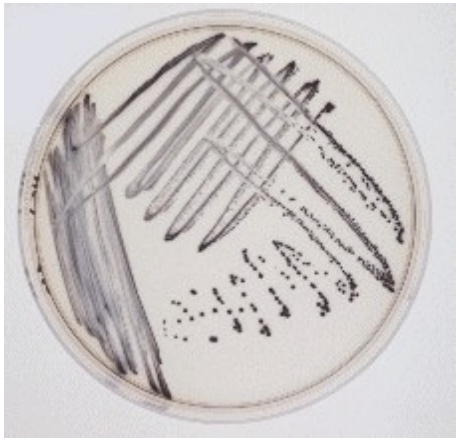
Public Health Apprentice Course

Food Pathogens



OVERVIEW

- **Foodborne illness**
  - Infection *vs.* Intoxication
- **Microbial organisms in foods**
  - Just what kinds of microbes are in foods
  - And are they all bad?
- **Important food pathogens**

The Food Pathogen Problem

- Eating may be hazardous to your health…
- Estimates of foodborne disease in U.S./yr:
  - 75 MILLION foodborne illnesses
  - Up to 5,000 deaths
  - What % of foodborne illness do you think is reported?

Adapted from: Council for Agricultural Science and Technology. Foodborne Pathogens: Risks and Consequences, 1994.

Foodborne Illness (2 types)

1. **INFECTION**
   - Ingestion of MICROBES IN FOOD causes illness
   - The microbes cause disease by
     - invasion of the gut or body
     - or toxin production *in* the gut/body (not toxin production in the food)

2. INTOXICATION

- Ingestion of FOOD CONTAINING a TOXIN causes illness
- Microbes produce toxins *while growing in the food*
  - Ingestion of the microbes themselves may be harmless
- What else could cause a foodborne intoxication?

Microorganisms in Food

What kinds (broad categories) of microorganisms could be in foods?

1.
2.
3.
4.

Microorganisms in Food: **Bacteria**

Types of bacteria in foods:

1. Pathogenic bacteria
   - Bacteria that cause intoxications
   - Bacteria that cause infections

   What other kinds of bacteria do you think could be in foods?
2.
3.

Bacteria Causing *Intoxications*

- ***Staphylococcus aureus*** ("Staph")
  - Reservoir: human skin and in nasal cavity--therefore commonly a problem in foods that are handled a lot
  - Transmission: Must multiply in food to produce enough toxin to cause illness
  - Disease: Mainly nausea and vomiting
  - Incubation period: Short!; usually 2 - 4 hours
  - The bacteria is killed by cooking, however the toxin is *not* destroyed by normal cooking!

- ***Clostridium botulinum*** (“botulism”)
  - Reservoir: Spores found in soil and water (ocean/lakes)
  - Transmission: Associated with improperly canned foods and ground-harvested foods such as onions and garlic
  - Disease: Toxin causes paralysis and death!
  - Incubation period: ½ day to 3 days
  - Spore not destroyed by cooking, *but* botulinum toxin CAN be destroyed by very hot cooking (e.g., food temp of 176F for at least 10 min)

Bacteria Causing *Infections*

- ***Salmonella* (non-typhoid)**
  - Reservoir: Food-producing animals
  - Transmission: Associated with undercooked meats (especially poultry) eggs, raw milk, and contaminated produce
  - Disease: Diarrhea and systemic infections (systemic infections means things like fever, weakness, etc.)
  - Incubation period: ½ day - 1½ days

- **Typhoid**
  - A special kind (species) of *Salmonella*:
    - ***Salmonella typhi***
  - Reservoir: HUMANS
    - (Remember what the reservoir for the other type of *Salmonella* was?)
  - So how is Typhoid transmitted?
  - Disease: fever, systemic
  - Incubation: days to several weeks

- ***Campylobacter*** (“Camp-ill-oh-bacter”)
  - Reservoir: Animals
  - Transmission: Associated with undercooked poultry and raw milk; also from direct contact with animals
  - Disease: Diarrhea (+/- bloody), systemic
  - Incubation period: usually 2 - 5 days

- ***E. coli* O157:H7**
  - Reservoir: Cattle, deer, other animals
  - Transmission: Associated with ground beef, apple juice, fermented meats, raw milk, PRODUCE, WATER
  - Disease: Diarrhea (usually bloody), kidney failure, death
  - Incubation period: 2 - 9 days
  - Note: Most *E. coli* bacteria don't cause illness, we all have them in our intestines. But this strain and a few others are pathogens.

- ***Clostridium perfringens***
  - Reservoir: Spore found in animal and human intestines; soil
  - Transmission: associated with large cuts of meat (i.e., large roasts or turkeys), stews and gravies
  - Incubation period: 10 - 12 hrs (about ½ day)
  - Disease: mainly diarrhea

- ***Listeria monocytogenes***
  - Reservoir: the environment (all over)
  - Transmission: Associated with many foods; often dairy, processed meats, and processed produce
  - Disease: Abortions, CNS infections, septicemia (blood infections)
  - Incubation period: days to weeks
  - Usually only a problem in very young or elderly people

- ***Shigella***
  - Reservoir: Humans
  - Transmission: Contaminated foods
  - Disease: Diarrhea (often bloody)
  - Incubation period: 1 - 3 days
  - Also a common concern in child development centers
  - Low infectious dose

I mentioned two bacteria that form spores--who cares?

Which ones were they?

1.

2.

- Note: there is one more pathogenic spore former that we won't cover in this course:
  - *Bacillus cereus*
- What's important about spores?

Bacterial Summary

- Which ones cause intoxications?
- Which ones cause infections?

Microorganisms in Food: **Viruses**

- Reservoir/transmission: Foodborne viruses are spread through human feces to food or water (not zoonotic diseases)
- Viruses can NOT grow in food
- *Do viruses cause infections or intoxications?*
- A common foodborne virus:
  - **Hepatitis A**
    - Key symptom: Jaundice
    - Long incubation period (mean: 28 - 30 days)
  - Other viruses: **Norwalk Virus, Rotavirus**

Microorganisms in Food: **Parasites**

- Parasites cause foodborne infections
- Parasites do NOT grow in food
- **Worms**:

  What are two common worms of concern in foods?

- **Protozoa**:

  What are two common protozoa of concern in foods?

Microorganisms in Food: **Fungi**

- Types of fungi in foods:
  - Molds
  - Yeasts
- Some fungi are used to enhance the flavor of foods
- But, many fungi cause food spoilage (bad taste/appearance)
- Some molds produce toxins which are pathogenic (Example: Aflatoxin)

Waterborne Pathogens

- Most of the same bacteria, viruses, and parasites that cause foodborne disease can also cause waterborne disease
- Pathogens that can be transmitted by the fecal-oral route have the potential to contaminate water and/or food
- How would water contaminate food?
  - Recipes made with water
  - Water is used for crops in the field

SUMMARY

- **Foodborne illness**
  - Infection *vs.* Intoxication
- **Microbial organisms in foods**
- **Important food pathogens**